Epidemiological patterns of scurvy among Ethiopian refugees

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In the Horn of Africa, scurvy is a serious public health problem for refugees who are dependent on standard relief food (cereals, legumes, and oil). To assess the risk factors and to quantify the potential magnitude of scurvy among these displaced communities, we reviewed data collected from 1985 to 1987 by relief programmes in five refugee camps in Somalia and one in the Sudan. Outbreaks of clinical scurvy occurred among refugees in all the camps from 3 to 4 months after their arrival. The incidence of scurvy in two camps was, respectively, 14% over a period of 4 months and 19.8% over a period of 18 months. Prevalences of scurvy estimated from random population samples in the six study camps ranged from 13.6% to 44%. The risk of developing scurvy increased significantly with the length of time that refugees had been in the camps and was also significantly higher among those who were older and among females, particularly those of childbearing age. The prevalence of scurvy among refugees was similar, irrespective of whether or not they had attended supplementary feeding programmes. The control measures that were implemented had a moderate and slow impact on the disease. In both Somalia and the Sudan the relief food distributed to the refugees was almost completely deficient in vitamin C, while the environment where the camps were located precluded an adequate supply of fresh food. To avoid scurvy among refugee communities in this area of Africa it is therefore recommended that vitamin C supplements be added to the relief food at an early stage of a crisis.

Introduction

Although large numbers of people in developing countries consume marginal amounts of vitamin C and have low levels of serum ascorbic acid, outbreaks of scurvy have been sporadic in recent decades (*7*). For example, in 1982 a sudden increase in clinical illness, including swollen knee joints, tenderness of limbs, and gum bleeding, among refugees of the Ogaden war in Somalia was diagnosed as scurvy (*10*). Other major outbreaks of scurvy occurred among Ethiopian refugees who sought assistance in Somalia and the Sudan in 1984–86. To estimate the magnitude of the disease among these refugee communities and to assess risk factors, we examined epidemiological data collected from 1985 to 1987 in selected refugee camps in Somalia (Gannet, Bixin, Biyoley, and Tugwajale–Dacawale[a] camps) and the Sudan (Wad-Kowli camp).

Background

Since 1979 more than 1 million Ethiopian refugees have sought assistance in Somalia and the Sudan, following political and economic disturbances in their homeland. After a previous flight during the 1979–81 Ogaden war, more than 100 000 Ethiopians belonging to Somali and Oromo ethnic groups migrated to northern Somalia between 1984 and 1986, where they were accommodated in the newly opened Gannet, Biyoley, Bixin and Tugwajale–Dacawale camps. In the eastern Sudan, where nearly 500 000 Ethiopian refugees were living before 1984, more than 300 000 additional refugees arrived from the Eritrean and Tigrean provinces of Ethiopia in early 1985. Wad-Kowli was one of the largest camps where these new refugees were accommodated (*12*).

In both host countries a national commission was responsible for providing health care to the refugees: the Refugee Health Unit (RHU) in Somalia and the Commission on Refugees (COR) in the Sudan. International, national, and nongovernmental organizations (NGOs), under the overall coordination of the Office of the United Nations High Commissioner for Refugees (UNHCR) and the

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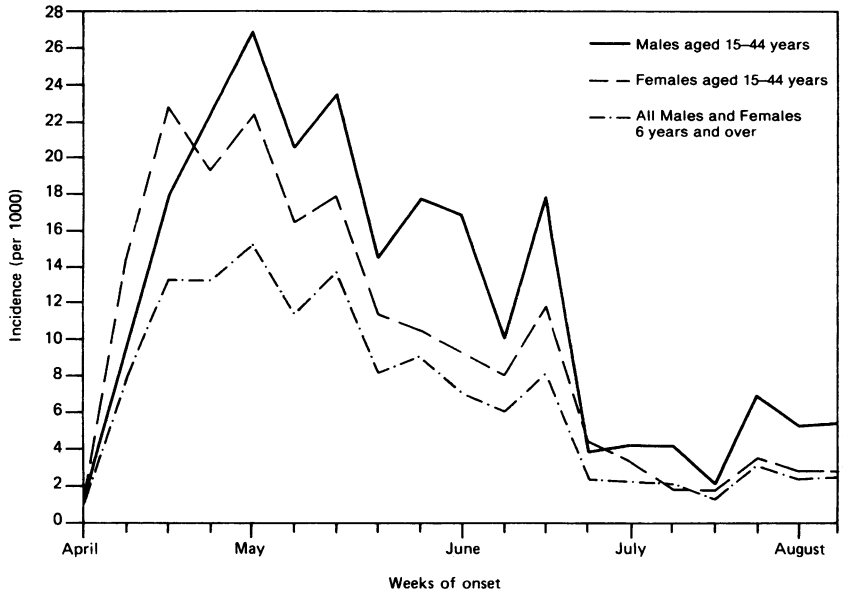
[a] The refugees in Tugwajale camp were all transferred to Dacawale camp in Feburary 1987.

Fig. 1. **Incidence of scurvy by week of onset among all refugees over 5 years of age and among males and females aged 15–44 years, Wad-Kowli camp, Sudan, April–August 1985.**



World Food Programme (WFP), were associated with these relief operations.

Generally, camps in both countries were remote and conditions were extremely poor, especially after the drought that had also affected Ethiopia in 1984–85. Thus the refugees depended entirely on goods delivered by the relief organizations. The recommended food rations (*3*) consisted of cereals, legumes, and oil, which provided 6300–10 500 kJ per person per day. Such a diet, without any supplement, provided less than 2 mg of vitamin C per person per day (*1*).

Materials and methods

We reviewed data collected by NGOs, UNHCR, the RHU, and the COR during relief programmes. In both Somalia and the Sudan, data on scurvy were collected from routine health surveillance records and surveys using a random cluster sampling methodology developed by WHO (*5*).

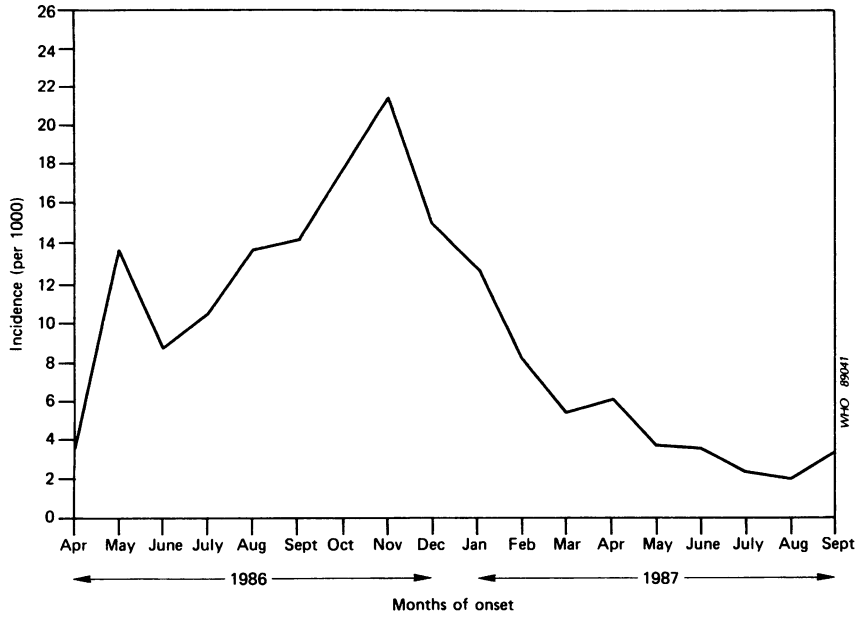
The general health surveillance system included a systematic collection of mortality and morbidity data (*11*) on a weekly basis during the acute phase, and on a monthly basis later. The diseases that were regularly monitored were limited and clinically defined. Upon the appearance of a new serious and frequent illness, such as scurvy, this was monitored also. Information on the age and, in some instances, sex of refugees was collected at the clinics, hospitals, and feeding centres in the camps. The number of refugees in the camps was available weekly or monthly from national authorities and UNHCR. The demographic structure of the refugee populations was estimated by carrying out repeated random surveys.

Information on scurvy obtained in random surveys included data on age, sex, and, according to the survey design, length of residence in the camp, attendance at feeding centres, and the pregnancy or breast-feeding status of women of childbearing age. In both Somalia and the Sudan individuals with either or both of the following criteria were taken to have scurvy: swollen gums with bleeding; and joint (knee, ankle, or hip), bone, or muscle signs—either the patient was unable to walk or stand because of painful muscles, bones, or joints or these areas were swollen and painful on palpation.

For surveys conducted in July 1987 in Somalia, individuals who had bleeding gums and bone or joint signs were taken to have scurvy.

In order to compare the results obtained with data on the prevalence of scurvy among residents in Wad-Kowli camp in the Sudan, systematic random samples of new arrivals (those who had spent less than a week in camp) and of individuals who attended feeding centres were investigated for scurvy. Data were analysed using the χ^2 test for trend, the Mantel-Haenzel χ^2 test, the rate ratio (RR), and the Taylor series 95% RR confidence interval (CI) (*8*).

Fig. 2. **Incidence of scurvy by month of onset among all age groups. Tugwajale-Dacawale camp, Somalia, April 1986 to September 1987.**



Results

In all the camps, cases of scurvy began to be reported within 3 to 10 months (median: 4 months) of the refugees' arrival. At Wad-Kowli camp, 4312 cases were notified from April to September 1985, while 4550 cases were reported at Tugwajale–Dacawale camp between April 1986 and September 1987. The corresponding cumulative incidences in these camps were, respectively, 13.9% and 19.8%. Plots of the incidence of scurvy in Wad-Kowli camp (by weeks) and Tugwajale–Dacawale camp (by months) are shown in Fig. 1 and 2, respectively. The highest incidences occurred during and immediately after the dry season (February to May in eastern Sudan and July to October in northern Somalia). The prevalences of scurvy estimated in the surveys are shown in Table 1. Prevalences among refugees 4 to 12 months after settling in the camps ranged from

Table 1: **Percentage prevalence of scurvy in selected refugee camps in Somalia (1985–87) and the Sudan (1985)**

Camp and date when settled	Date of survey	Sample population	size	Prevalence (%)
Somalia				
Bixin: September 1984	September 1985	35 000	535	44.0[a] (39.8–48.2)[b]
	July 1987	35 000	882	5.2[c] (3.7–6.7)
Gannet: January 1985	September 1985	30 000	1038	25.3[a] (22.4–27.6)
Tugwajale: January 1986	April 1986	35 000	1030	13.6[a] (11.5–15.7)
Dacawale[d]: February 1987	July 1987	25 000	986	6.9[c] (5.3–8.5)
Biyoley: December 1985	August 1986	35 000	1029	42.2[a] (39.2–45.2)
	July 1987	35 000	921	18.2[c] (15.7–20.7)
Sudan				
Wad-Kowli: December 1984	April 1985	50 000	1016	22.0[a] (19.5–24.5)

[a] Scurvy was defined as the presence of bleeding gums *or* bone or joint signs.
[b] Figures in parentheses are the 95% confidence intervals.
[c] Scurvy was defined as the presence of bleeding gums *and* bone or joint signs.
[d] The refugee population of the Tugwajale camp was transferred to Dacawale camp in February 1987.

Table 2: **Percentage incidence of scurvy by age and sex, Wad-Kowli camp, Sudan, April–August 1985**

Sex	Age range				
	0–4 years	5–14 years	15–44 years	>44 years	⩾5 years
Male	—	2.9	24.1	27.3	15.1
Female	—	2.2	20.2	15.6	13.0
Total	—	2.5	21.7	23.0	13.9

13.6% (95% CI: 11.5–15.7%) in Tugwajale camp to 44% (95% CI: 39.8–48.2%) in Bixin camp. The likelihood that the prevalence of scurvy was high increased with the delay between the arrival of the refugees at the camp and the survey date (Table 1).

The incidences of scurvy by age and sex for the duration of the Wad-Kowli outbreak are given in Table 2. Although cases were identified among the under-5-year-olds at the beginning of the outbreak, no data for the later stages were available for this age group. Among over-5-year-olds the incidences were higher for males (15.1%) than females (13%), (RR = 1.16; 95% CI: 1.11–1.24; $P < 10^{-4}$) and increased with age (χ^2 test for trend, $P < 10^{-6}$). In Wad-Kowli camp the incidence of scurvy was higher among females (2.3%) than males (2%) during the first 3 weeks of the outbreak in April 1985 (RR = 1.15; 95% CI: 1.01–1.29; $P = 0.04$), but subsequently until August 1985 this pattern was reversed (10.5% for females and 13.3% for males; RR = 0.79, 95% CI: 0.74–0.84; $P < 10^{-6}$). This difference by sex was most predominant among 15–44-year-olds (Fig. 1) with incidences during the first 3 weeks of the outbreak of 3.76% for females and 2.83% for males (RR = 1.33; 95% CI: 1.14–1.55; $P < 0.001$). At Tugwajale–Dacawale camp the incidence from April 1986 to September 1987 for those aged at least 5 years and for those aged under 5 years was, respectively, 21.6% and 15.1% (RR = 1.43, 95% CI: 1.33–1.53, $P < 10^{-6}$).

In both Somalia and the Sudan, the prevalence of scurvy was always higher among females than among males (Table 3), with the RR for females to males ranging from 1.05, (95% CI: 0.86–1.27; $P = 0.6$, not significant) at Bixin camp (in 1985) to 1.25 (95% CI: 1.07–1.47, $P < 0.005$) at Biyoley camp (in 1985). The largest RR for females to males occurred among 15–44-year-olds (RR ranging from 1.02 (95% CI: 0.76–1.32; $P = 0.9$) to 2.19 (95% CI: 1.39–3.36, $P < 0.0005$). The prevalence of scurvy increased generally with age (χ^2 test for trend, $P < 0.05$, Table 3).

Scurvy was more prevalent in camps that were located in poorer and more remote or desert areas (Bixin and Biyoley, Table 1). In July 1987 at the beginning of the dry season, the disease was still prevalent in the Somali camps, primarily in the most remote ones such as Biyoley (18.2%; 95% CI: 15.7–20.7%, Table 1).

The overall prevalence of scurvy among refugees increased with their period of residence in the camps. Table 4 shows the age- and sex-adjusted prevalences of scurvy in April 1985 among new arrivals and residents (by duration of residence) at Wad-Kowli camp: the prevalence increased from 4% upon arrival to 29.6% after ⩾4 months in the camp (χ^2 test for trend, $P < 10^{-6}$). In August 1985 refugees who had been living in Gannet camp for >6 months were 1.4-times (95% CI: 0.8–2.2, $P < 0.05$) more

Table 3: **Percentage prevalence of scurvy by sex and age in selected refugee camps in Somalia (1984–87) and the Sudan (1985)**

Camp	Date	Sex		Age group			
		Male	Female	0–4 years	5–14 years	15–44 years	⩾45 years
Somalia							
Bixin	September 1985[a]	43.1	45.2	28.8	37.2	47.7	78.4[b]
	July 1987[c]	4.3	5.9	1.0	4.4	6.8	15.3[b]
Gannet	September 1985[a]	22.3	26.9	16.6	25.9	24.1	40.0[b]
Tugwajale	April 1986[a]	12.5	14.7	1.5	10.7	22.2[b]	22.2[b]
Dacawale	July 1987[c]	5.6	7.8	5.8	6.9	7.9	4.9
Biyoley	August 1986[a]	36.0	45.1[d]	20.4	38.0	52.4	70.5[b]
	July 1987[c]	17.0	19.2	5.0	15.9	24.6	46.8[b]
Sudan							
Wad-Kowli	April 1985[a]	19.6	24.2	10.3	19.1	27.1	34.0[b]

[a] Scurvy was defined as the presence of bleeding gums *or* bone or joint signs.
[b] χ^2 test for trend, $P < 0.05$.
[c] Scurvy was defined as the presence of bleeding gums *and* bone or joint signs.
[d] χ^2 test, $P < 0.05$.

Table 4: **Prevalence and rate ratio of scurvy by duration of residence among random samples of new arrivals and residents, Wad-Kowli camp, Sudan, April 1985**

Duration of residence	No. in sample	No. with scurvy	Rate ratio (RR)[a]	95% confidence limits on RR[b]
New arrivals (<7 days)	100	4 (4)[c]	1	—
7 days to 1 month	183	28 (15.3)	3.83	1.38–10.60
2–3 months	199	41 (20.6)	5.15	1.90–13.98
⩾4 months	162	48 (29.6)	7.40	2.75–19.93

[a] RR for females to males; χ^2 test for trend, $P < 10^{-6}$.
[b] $P < 0.001$.
[c] Figures in parentheses are percentages.

likely to have scurvy (24%) than those who had been there for <6 months (17%).

The prevalence of scurvy among pregnant and breast-feeding women in selected Somali camps is shown in Tables 5 and 6, respectively.

Data on the prevalence of scurvy among the refugees surveyed in Somalia in 1985, stratified according to whether they attended supplementary feeding centres, are summarized in Table 7. The results indicate that the prevalence was similar irrespective of whether refugees were enrolled or not in a feeding centre prior to the survey ($P > 0.05$ after stratification for age). In April 1985 in Wad-Kowli camp the prevalence of scurvy among a systematic random sample of 108 under-5-year-olds who attended feeding centres was 21%, twice (95% CI: 1.2–3.6, $P < 0.01$) that among all under-5-year-olds in the camp (10.3%).

Discussion

Scurvy was a major public health problem for the refugee populations that we have reported here. Outbreaks occurred after 3–4 months' consumption of relief food that contained no more than 2 mg of

Table 5: **Prevalence of scurvy among samples of women of childbearing age, according to their pregnancy or breast-feeding status, in selected refugee camps, Somalia, September 1985 or August 1986**

	Camp					
	Bixin[a]		Gannet[a]		Biyoley[b]	
Women's status	No. surveyed	No. with scurvy	No. surveyed	No. with scurvy	No. surveyed	No. with scurvy
Pregnant or lactating	43	28 (65.1)[d]	64	24 (37.5)	72	39 (54.2)
	$P < 0.05$[c]		$P = 0.12$, not significant[c]		$P = 0.7$, not significant[c]	
Not pregnant or not lactating	106	45 (42.5)	195	53 (27.2)	263	149 (56.7)
Total	149	73 (49)	259	77 (29.7)	335	188 (56.1)

[a] Survey was carried out in September 1985.
[b] Survey was carried out in August 1986.
[c] Mantel-Haenzel χ^2 test.
[d] Figures in parentheses are percentages.

Table 6: **Prevalence of scurvy among samples of women of childbearing age, according to their pregnancy or breast-feeding status, in selected refugee camps, Somalia, July 1987**

	Camp					
	Bixin		Biyoley		Dacawale	
Women's status	No. surveyed	No. with scurvy	No. surveyed	No. with scurvy	No. surveyed	No. with scurvy
Pregnant or lactating	40	6 (15.0)[c]	55	21 (38.2)	56	9 (16.1)
	$P < 0.05$[a]		$P < 0.05$[b]		$P = 0.09$, not significant[b]	
Not pregnant or lactating	214	12 (5.6)	187	43 (23.0)	215	18 (8.4)
Total	254	18 (7.1)	242	64 (26.4)	271	27 (10.0)

[a] Fisher's exact test.
[b] Mantel-Haenzel χ^2 test.
[c] Figures in parentheses are percentages.

Table 7: **Prevalence of scurvy in selected refugee camps in Somalia, September 1985 or August 1986, according to attendance at supplementary feeding centres, stratified by age**

Attended feeding centres:	Camp					
	Bixin[a]		Gannet[a]		Biyoley[b]	
	No. surveyed	No. with scurvy	No. surveyed	No. with scurvy	No. surveyed	No. with scurvy
<5 years' old						
Yes	25	7 (28.0)[e]	67	11 (16.4)	57	9 (15.8)
No	83	27 (32.5)	148	18 (12.2)	203	47 (23.2)
	$P = 0.3$, not significant[c]		$P = 0.9$, not significant[c]		$P = 0.8$, not significant[c]	
≥5 years' old						
Yes	36	22 (61.1)	69	18 (26.1)	73	41 (56.2)
No	381	172 (45.1)	754	211 (28.0)	696	337 (48.4)
Total	525[d]	228 (43.4)	1038	258 (24.9)	1029	434 (42.2)

[a] The survey was carried out in September 1985.
[b] The survey was carried out in August 1986.
[c] Stratified by the Mantel-Haenzel χ^2 test.
[d] Data were available for 525 of the 535 refugees surveyed.
[e] Figures in parentheses are percentages.

vitamin C per day (*1*). Since, at that time, no fresh food was distributed or available in significant quantities for purchase, the daily requirement of 10 mg of vitamin C to avoid deficiency could not be met (*16*). The prevalence of scurvy increased among refugees with their residence time in camps in both Somalia and the Sudan, and this suggests that there may be a dose effect between the prevalence of scurvy and the duration of consumption of relief food.

Despite reports of cases of scurvy among new arrivals to camps, the median duration of exposure to vitamin-C-deficient relief food before the peak of the outbreak (4 months) is similar to that observed for healthy volunteers fed on a vitamin-C-deprived diet (*6*, *7*). After a similar period, groups that had higher vitamin C requirements, e.g., women of childbearing age, lactating and pregnant women, and the elderly (*16*), exhibited the highest prevalence.

The high prevalence of scurvy among refugees aged >45 years (Table 3) might be related to the greater prevalence of other bone or joint disorders in this age group. Nevertheless, the prevalence remained the highest among the elderly when scurvy was defined as the association of bone or joint signs with bleeding gums (1987 surveys, Table 3), and this suggests that there was a true higher risk of scurvy among those aged >45 years.

Although patients with scurvy improved dramatically when treated daily with 0.5–1 g of vitamin C for 2 to 3 days, the slow decrease in the incidence (Fig. 1 and 2) and the high prevalence of scurvy in some of the Somali camps in July 1987 (Table 1) are consistent with reports that the control measures implemented had a lasting effect.[b] Depending on the camp, the interventions included distributing vitamin C tablets and/or fresh food (lemons, onions, etc.) to the whole population or to targeted groups in feeding centres, and/or the addition of corn soya milk (CSM) powder (which contains 40 mg vitamin C per 100 g (*14*)) to the basic ration. These measures required an education campaign in order to reach the entire population and were implemented at a time when relief workers were busy with other priorities, such as providing camps with water, shelters, immunization, and sanitation facilities (*12*, *13*). Despite these constraints, at Wad-Kowli camp the incidence of scurvy decreased more rapidly among females of childbearing age than among males (Fig. 1), and this suggests that such women were better protected when control measures were implemented. The provision of vitamin C tablets at mother and child health services in the camp may explain this sex difference.

Attendance at supplementary feeding centres and the distribution of cooked rations prepared with formula milk, such as CSM, were not associated with any preventive effect. This may have arisen because of the relatively low concentration of vitamin C in CSM, and the poor heat and storage stability of the vitamin (*4*, *15*) may have limited its impact.

More than 100 000 cases of scurvy, with a very high rate of preclinical deficiency, have occurred in

[b] **Jaspers, S.** *Report on citrus distribution, north-west Somalia.* Unpublished document. Refugee Health Unit/Médecins sans Frontières Holland, 1987.

recent years among refugees in the Horn of Africa. It could therefore be asked whether vitamin C deficiency might have contributed to the very high mortality and morbidity rates reported in this region (*13*). Since vitamin C has been advocated to protect against infection (*9*) and increases the absorption of iron by the body (*2*, *4*, *7*), it is likely that such a deficiency may play a role in causing infectious diseases and anaemia among refugees.

Outbreaks of scurvy raise the issue of whether the standardized food aid (*3*) provided to refugees is adequate. Since little extra food is available in the camps and control measures have low efficiency, preventive interventions need to be introduced at an early stage. To remain efficient, prevention of scurvy should be associated with provision of basic and regular general relief rations to refugees, and at the acute phase these should include fresh vegetables or fruit. Mid- and long-term solutions should be based on developing the self-reliance of refugees through education campaigns and by encouraging home gardening efforts. Fortification of cereals used for food aid with a sufficient amount of ascorbic acid should also be considered by donor countries.

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Résumé

Caractéristiques épidémiologiques du scorbut chez les réfugiés éthiopiens

Depuis 1980, plus d'un million de réfugiés éthiopiens ont cherché secours en Somalie et au Soudan. En conséquence, des programmes d'aide ont été mis sur pied par les pays hôtes et la communauté internationale, programmes qui ont été coordonnés par le Haut Commissariat des Nations Unies pour les Réfugiés (HCR). L'une des principales tâches a été l'approvisionnement des réfugiés en nourriture. Les rations distribuées ont été conformes aux recommandations habituelles pour l'aide alimentaire d'urgence et ont consisté en céréales, légumineuses et huiles—substances qui ne contiennent pratiquement pas de vitamine C.

Cet article présente les données relatives au scorbut recueillies dans certain camps de réfugiés de Somalie et du Soudan entre 1985 et 1987 lors des visites de surveillance sanitaire de routine. Dans la plupart des camps, les poussées de scorbut clinique se sont produites 3 à 4 mois après l'arrivée des réfugiés, en particulier après la vague de 1984–1985. Dans deux de ces camps, l'incidence du scorbut a été respectivement de 14% (période de 4 mois) et de 18,9% (période de 18 mois). La prévalence du scorbut, estimée au moyen de sondages par grappes, allait de 13,6% à 44%. L'incidence comme la prévalence du scorbut ont augmenté avec la période pendant laquelle les réfugiés sont restés dans les camps et ont été également les plus fortes chez les personnes âgées, les femmes, en particulier les femmes en âge de procréer, et au cours de la saison sèche ainsi que dans les camps situés dans les zones les plus pauvres. La prévalence du scorbut chez les réfugiés a été la même qu'ils aient ou non bénéficié des programmes de distribution de suppléments vitaminiques.

Bien qu'on ait engagé une action préventive dès la confirmation des premiers cas de scorbut, cette affection était encore très répandue dans la plupart des camps, en particulier au cours de la saison sèche, 1 à 2 ans après l'arrivée des réfugiés.

Cette carence en vitamine C a probablement eu des répercussions plus larges que le scorbut sur la santé publique, provoquant chez les réfugiés de l'anémie, une diminution de l'activité physique, une sensibilité accrue aux infections et contribuant ainsi aux forts taux de mortalité.

En Somalie comme au Soudan, l'aide alimentaire distribuée aux réfugiés manquait de vitamine C (moins de 2 mg par personne et par jour). En outre, l'environnement pauvre dans lequel ces camps ont été implantés n'a pas permis un approvisionnement suffisant en nourriture fraîche.

En conclusion, il faudrait ajouter des suppléments de vitamine C sous une forme appropriée aux rations généralement distribuées dès qu'une vague de réfugiés arrive. Dans la mesure du possible, on distribuera de la nourriture fraîche, qui reste la meilleure façon d'apporter de la vitamine C en période de carence aiguë. Il faudra également que les pays donateurs envisagent d'ajouter de la vitamine C aux céréales envoyées pour l'aide alimentaire d'urgence. Bien que ces mesures soient coûteuses, elles sont nécessaires pour éviter que l'une des maladies évitables les plus anciennes ne touche les communautés les plus profondément démunies.

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